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ABSTRACT

Women stand to lose a great deal in the information revolution if they fail to master computer technology. Presently they are taking little part in the computer field. In the future, access to jobs, information, and power will depend on computer knowledge and skills. Women will be pushed into lower status jobs or out of jobs altogether, perpetuating their position as secondary members of society. Because of this threat, it is imperative that measures be taken to insure that girls are provided with adequate computer instruction. Schools are doing little to offset the existing inequity. Computers are used almost solely in math classes, traditionally a male domain. Even for girls taking math, there are few women teaching the courses and therefore few women using computers to serve as role models. Girls' lack of enthusiasm for computers is a result of all these factors as well as the aggressive behavior of boys in securing computer time. Outside the schools, computer companies reinforce the notion of computers as a male interest through their computer games and advertising. It is clear that special programs, including the integration of computers into subjects other than math, must be developed in order to include girls in computer education and alleviate the present inequitable distribution of knowledge and power in our society. (LP)

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COMPUTERS IN THE CLASSROOM: A FEMINIST ISSUE

By
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Like the erector set at the elementary school level, the woodworking shop in the junior high and middle schools, and the high school or university physics lab, the computer in education may be serving one section of our school population differently than another. Many women may have learned to compensate for the missing knowledge or skills provided to their brothers during their public school careers in areas such as the use of tools or in the field of science; that loss, for some, has inspired them to work to insure that girls and young women in public schools today have a better chance. Efforts toward compliance with Title IX are a reflection of this. The computer, however, is affecting our world in ways only the future will reveal. Some predict that its impact upon society can be compared to that of the Industrial Revolution. In some aspects, women's positions at that time took a turn for the worse; from being an essential member of a family industry, many women found themselves in routinized and unpleasant factory work (for someone else's profit) or left behind in the home in a role of subservience to their husbands. Women must not allow a comparable step backwards during the Computer Revolution; they must be full participants in the Computer Age and not be denied opportunities in such a dominant aspect of their futures. The challenge to feminist educators is clear.

This paper argues that, because of the importance of computers and their special significance to women as a subordinate group, and because our schools have traditionally acted to perpetuate differential sex roles, special programs

should be developed in our schools for girls and young women. I will examine the reasons why educational outcomes are different for girls and boys in our public schools and argue that the denial of opportunities to girls is both unjust and unnecessary. Within this area I will identify sources of resistance to changes in our present gender situation and to the computer itself. I will report on what is being done in the area of computer education, especially as it affects women, and seek solutions to the problem.

That knowledge of computers will soon be necessary in order to fully participate in our society has been widely predicted. "Computer literacy" has become a frequent topic of articles in recent educational journals. PHI DELTA KAPPAN, for example, devoted its January, 1982, issue to the Computer Age in Education. EDUCATIONAL LEADERSHIP, the journal of the Association for Supervision and Curriculum Development, included two articles on computer literacy in its October issue during the same year. Within the last two years, SCHOOL SCHEICE AND MATHEMATICS, THE MATHEMATICS TEACHER, and THE READING TEACHER have all had articles which address the topic. The message is clear that there is near agreement as to the aspects of computer literacy and that it is the schools' responsibility to impart this knowledge to students.

"Computer literacy" is most simply defined as whatever a person needs to know about and be able to do with computers in order to function competently in our society (Winkle, p. 314). In order to measure secondary school teachers' opinions of what constituted computer literacy for their students, a

study was undertaken by the Special Projects Division of the Minnesota Educational Computing Consortium in Spring, 1978. A survey was sent to all math, science, computer science, data processing and business education teachers asking them to rate on a five-point Likert scale their agreement with statements on computer knowledge. All agreed that every student needed a minimal understanding of computers and of their role in society. Agreement was not as strong in the other component, but many felt that students should be taught skills in programming.

Jane Gawronski, in her article "Computer Literacy and School Mathematics," states that students should know what a computer can do, what a program can do, and how to program. She cites the 1978 report of the National Council of Supervisors of Mathematics:

> "It is important for all citizens to understand what computers can and cannot do. Students should be aware of the many uses of computers in society, such as their use in teaching/learning, financial transactions and informations storage and retrieval." (p. 613)

Similarly, Holloy O'Donnell's article, "Computer Literacy, Part 1: An Overview," points to computer knowledge, societal implications, an programming skills as the major components.

Knowing what computer literacy is, however, is not enough to convince us of its necessity. Access to jobs and information and thus, power, is the basic concern here. Writing on the affect of technology on the future of women, Jan Zimmerman states:

> "By the year 2000 living without a computer, in a state of information poverty, will effectively exclude people from many day-to-day activities in society and will certainly exclude them from poverty" (p. 357).

The Committee on Computer Education of the Conference Board of the Mathematical Sciences (CBMS) concluded in their 1972 report that "the average U.S. citizen hasn't the foggiest idea of how computers work. (He) is, in short, culturally disadvantaged." (Hansen, p. 467) To Winkle, computer literacy is a basic survival skill. (p. 314) It is predicted that within the next two decades as many as 75 percent of the work force will need computer skills in their jobs. (Turkington, p.1) Clearly, computer illiteracy will place people in a severly disadvantaged position by the year 2000, if not before.

I believe that because women already are secondary members of our society, unless we become skilled in and knowledgeable about computers, our lower position will be reinforced. Women could become further shut off from the power to determine how society functions. Like the introduction of the power loom which displaced over 200,000 handweavers in England (Arnold, p. 323) , the computer could do more harm than good if we don't use it to our advantage. Technology, Joan W. Scott warns us, is not inherently revolutionary.

Adeline Naiman, managing director of Technical Education Research Centers in Cambridge, Mass., has a further warning:

> "I am very concerned about who gets control of the technology. In a democracy, in order for people to know how to make their own decisions, it will be important for them to understand computers. . .(in schools). . .there is a climate of expectation on the part of teachers that boys will enjoy, and be good at, computer work." (Turkington, p. 30)

She points to the eventual effect this will have on access to jobs and ultimately, to power.

The American Association of University Women, with over 190,000 members, shares Naiman's concern. This organization has selected "Taking Hold of Technology" as their topic for a two-year study/action program which began in July, 1981. Corlann Gee Bush describes the significance of the choice. "Women want to understand and have a voice in the technological innovations and decisions that affect their lives." (p. 373) Technology, she says, has always been the domain of white, male professionals. These women want to analyze and assess technology, and acquire the skills needed to use it to their benefit.

One of the concerns of the AAUW action/study program is women's reluctance to become involved with technology, usually referred to as technophobia or technology anxiety. These women work to overcome this in themselves and in others, especially young women.

"To avoid the struggle with technology is to condemn women to their history," writes Jan Zimmerman. (p. 355) We must, she argues, gain control over the development and implementation of technology, because if women don't use it, it will use and control women.

One area in which women stand to lose is on the job. Secretaries, for example, represent a work force which is 99 percent female (Howe, 1977). The microprocessor has the capability of replacing these women and making their skills unnecessary. Word processing, first, deskills the job of typing by making retyping unnecessary and greatly simplifying the job of changing the text. The typing/management relationship is also changed, according to Eric Arnold and his associates in "Women and Microelectronics." Management can specify precisely how a job is to be done, decreasing the already limited decision making power of the typist. They did not report the frequency with which management uses it, but microprocessors would have a mechanism to monitor a typist's rate of work by the number of key depressions. Thus, as management gains control over the work process, typists lose it. The time and effort saved by word processing is not an advantage for a typist, but rather for the management. Her only freedom will be to go on to the next job; "the capitalist appropriates the time and effort saved by the machine." (Arnold, p.329)

Another possibility for the use of the computer in jobs is that people will be able to carry home a terminal and maintain an information exchange with the office boss. Jan Zimmerman describes the potential of this innovation--flexible work-hours, shared parenting done by parents in the home, jobs for the physically handicapped, and a reduction in gasoline consumption and pollution. (p.358) However, she quotes Alvin Toffler's THE THIRD WAVE, (1980) in which he says that the

microprocessor could allow "married secretaries caring for small children at home to continue to work." In other words, women may find themselves back in the home where they are thought to belong. "Computers at home could allow women, that is, to do not one, but two jobs in their cozy, rose-covered, picket-fenced, white frame, electronic bungalows." (Zimmerman, p. 358)

Computers as information systems have great potential for people, but only for those who have control over data entry. Zimmerman tells us that of the three major data base services in the U.S., ORBIT, DIALOG and NTIS, which provide information to people by mail or phone request, none has a data base on women. Information is available on agriculture, energy, law, medicine, accounting, education. But women and minorities, because they do not control data entry, do not determine what questions are asked, which data are gathered, or which categories used, are left out of this important aspect of computer progress.

In summary, we see that computers have the potential of improving the lives of women, but unless present trends are stopped, women could be pushed into more alienating, low-status jobs, or out of jobs altogether; they could be double bound to the home; and, they could be denied access to the information being used by others to make decisions which affect their lives. (Zimmerman, p. 359)

It is the common belief among educators in our society, and in fact among most Americans, that it is the responsibility of schools to use the past in order to help

make a better future. It is not the purpose of schools to define and tolerate the present inequities in our society. Rather than limit the potential of students, schools should promote the growth and development of each child. Rather than reproduce the sexism in society, schools could work to eliminate it. Writing in NON-SEXIST EDUCATION FOR SURVIVAL, Elizabeth Koontz says that

> "the school system is the institution through which we expect all citizens to gain knowledge of the traditions, mores and culture they are to perpetuate. If that system perpetuates biases and prejudices that limit development of one's self-concept and ability, it must be examined to ascertain the reasons for failure, and it must take corrective action." (1973, p.6)

The ways in which schools perpetuate and reproduce inequality has been the subject of many educational reformers and critics in the past two decades. According to Bowles and Gintis, representative of the the neo-Marxist analysis, our "educational system serves--through the correspondence of its social relations with those of economic life--to reproduce economic inequality and to distort personal development." (1976, p.48) Even our legislators agree that schools are at fault in this area. The first section of the Women's Educational Equity Act (1974), designed to promote equity for girls and women through educational programs, states,

> "the Congress finds and declares that educational programs in the United States, as presently conducted, are frequently inequitable as such programs relate to women and frequently limit the full participation of all individuals in American society." (Federal Register)

The passage of Title IX in 1972 was intended to address the

problem of differential treatment given to females and males in schools, as was the establishment of Title IV-C Sex Desegregation Assistance Centers and Training Institutes. Sexism in schools has not been a hidden phenomenon.

Schools are sexist both in the actual curriculum, the knowledge and skills which are intentionally taught to students, and in the hidden curriculum, the transmission of values and attitudes through policies and practices. Feminists have pointed to the omission of women from the curriculum: students do not learn about women because they are not included in texts and other materials. Stereotyping is another way in which sexism is revealed; women in readers are mommies in aprons, while daddies go off to do important work. Boys are pictured in math and science books performing interesting tasks, while girls either are absent, assisting in the background, or in the kitchen measuring half-cups of recipe ingredients. (WOMEN ON WORDS AND IMAGES, 1975) Even though several textbook publishers have established guidelines for the elimination of sexism in language, words like 'forefathers,' 'chairman,' 'congressman,' and 'fireman' still abound. How could we expect girls to feel qualified for these roles? As long as the generic 'he' and 'man' are used to designate person, girls and women will be left out.

Students may learn that there are different expectations for girls and for boys in the classroom. For example, girls are more likely to be praised on how they look and boys on how they perform. Young children may learn that there are appropriate areas of the room for members of each sex, and

thus, different play or work activities. Unless they are very lucky, they soon learn that males are the favored members in society and the role of the female is secondary.

Aspects of the hidden curriculum in which students learn acceptable roles for females and males also include the composition of jobs within the school. Women are the teachers (88% at the elementary level and 50% at secondary) and men are the principals (78% at elementary, 96% secondary). (Clement, p. 132) At the secondary level, women more frequently teach English, languages, and fine arts, while men teach math and sciences.

It follows then, that students come to believe that math and science are fields of study more appropriate for males than for females and that men have jobs with more power and prestige than women, and, in fact, with power and direction oven women.

Bearing in mind the dominance of computers in society, their possible effects on women, and the tendency of schools to maintain the social, political, and economic structures of that society, I shall now turn to the possible impact on students, especially girls and young women, when computers and the curriculum combine and argue that there is a problem of computer equity.

Math anxiety, prevalent among female students and their teachers, would seem to be closely related to the technophobia mentioned earlier. Historically mathematics has been thought to be a masculine domain, writes Vicky Kirschner in "What Research Says: Females and Mathematics," but she concludes

that there are no inherent factors which keep girls from learning mathematics at the same level as boys.(p.511) It is, rather, sociological factors which lead to differences in achievement in math for the two sexes. She cites studies showing that students are affected by the differential treatments and expectations they perceive from their teachers (Bean, 1976; Parsons et al., 1979; Good, et al., 1973, Fennema and Sherman, 1976; Becker, 1981).

Those girls and young women who do achieve in mathematics are the subject of the WOMEN IN MATHEMATICS survey done by Jan Armstrong in 1980. Kirschner summarizes that girls are more likely to continue taking math if they feel that they are likely to succeed in it (usually an attitude instilled by their parents), if they perceive math to be useful in their future, and if they have the positive influence of teachers, counselors, parents, or other role models.

At Lawrence Hall for Science in Berkeley, Nancy Kreinberg and her colleagues have been conducting "Math for Girls" programs for over four years. She agrees with Kirschner's conclusions in her recent article in WOMEN'S STUDIES QUARTERLY (Fall, 1982) that the three aspects of girls' reluctance to take elective mathematics are their perception of its usefulness, their estimation of their ability to be successful, and the attitudes of parents, teachers and peers. (p.18) It is unfortunate that one of the studies Kirschner cites (Casserly, 1975) ascertained that parents seem to have lower expectations for their daughters than for their sons, especially since it is most likely that teachers and peers are

not encouraging the girls to succeed in mathematics either.

Resistance to change, whether it be the study of mathematics by girls or the introduction of computers to classrooms, is prominent among teachers. For example, in an attempt to measure the sex role bias of people in various occupations, Lacy, Middleton, and Lacy (1979) found that of those teachers who responded to their survey, 51 percent believed that the man should be the achiever outside the home and 42 percent, that the wife should help the husband's career at the expense of her own. Forty-two percent also believed that preschool children suffer if their mother works and 32 percent believed that a working mother cannot be as good a mother as a "nonworking mother." (cited by Rampy, p.11)

Are pre-service teachers as traditional? Unfortunately for education, the feminist movement has encouraged many bright young women to go into other professions which have previously been considered appropriate only for men. Toni Antonucci summarizes the qualities of the female education student as: more traditional and less career-oriented than both male education students and most noneducation students of both sexes; women frequently report entering education as an interlude before or between marriage and children, they tend to have lower aspirations about their careers in education and tend to be generally poorer students. (cited by Lather, p.6)

It is unlikely that the education of pre-service teachers is helping to prepare for change. Florence Howe wrote that schools of education are "among the most resistant to the impact of the women's movement" (1979, p.413). Shirley McCune

and Marty Matthews commented that:

> "Just as our schools have largely transmitted the sex role expectations and cultures of the past rather than expanding the options and capacities of females and males for the future, so teacher education has functioned to model and perpetuate those and other conserving effects on education rather than assuming leadership for educational and societal change." (1975, p.297)

One aspect of teacher education which may contribute to the lack of acceptance of social change is the rigid structure of most pre-service programs. Students typically have few options or electives (and they seem to like it that way)(Sears, 1982); concerns such as sex equity and computer education are most often "mainstreamed" into the curriculum of general methods courses. At Indiana University, some education majors at both elementary and secondary levels are given two weeks of instruction in the microprocessor. The amount of attention to sex equity concerns, if any, is based upon the interests and concerns of the instructor.

James Armsay and Norman Dahl have attempted to identify the reasons why teachers resist the use of instructional technology, especially computers, in their classrooms. First on their list of four items is the basic conservatism of the education establishment. Their other reasons, however, give us special insight into the attitudes of teachers towards computers and the ways they have been introduced to the classroom. They are:

> "fear of the effects of instructional technology on their roles and responsibilities; the ineptitude and insensitivity of the hardware people; and the minimal or non-existent involvement of teachers at every

stage of the process." (1973, p.10)

As a group particularly resistant to change, teachers are apt to fear any change in their jobs, and the computer, it is believed, has that potential. It can grade tests, analyze scores, keep attendance, and, of course, it can teach. It is endlessly patient, always has the right answer, and it is attractive to students. It can make learning almost effortless. Mary Alice White, psychologist and director of the Electronic Learning Laboratory of Teachers College, Columbia University, has been observing students' interactions with computers and observes:

> "Schooling will never be the same, learning will never be the same, teaching will never be the same." (cited in Turkington, p.1)

One change that teachers foresee and fear is that students may become more skilled in using computers than their teachers. Not many teachers are as enthusiastic about learning along with their students as Herb Kohl is (1982, p.20), and probably even fewer would enjoy being taught by their students.

The number of computers in schools is increasing at a rapid rate; teachers will no longer be able to ignore or otherwise resist their presence. The December, 1982 PHI DELTA KAPPAN has this feature heading in its regular Newsnote section: "School Microcomputers Triple Since 1980, NCES (National Center for Education Statistics) Survey Shows." 96,000 microcomputers were in 29,000 of the 82,000 public schools in spring, 1982, the report claims. Three-fifths of these are secondary schools and about half of the high schools reported that their major use for them was in the teaching of

computer science (p.294). No mention was made of the sexual make-up of the computer science courses, nor of the teachers. We probably already know.

Boys are enthusiastic about computers. They fight and scheme to get to them (Silvern, 1982); they stay hours after regular school hours have ended and come to school early if they'll be able to use computers. They work and save, or they ask their parents to buy personal computers. At Rensselaer Polytechnic Institute, only one woman and 60 men participated at a recent meeting of the Association for Computing Machinery, according to a BUSINESSWEEK column, "If Women Don't Go Into Computers." (June 21, 1982, p.102) It also reported that while 75 men brought personal computers to school, not one woman did.

Lack of enthusiasm for computers on the part of girls, then, can be seen as a combination of factors: cultural bias telling them technology is a male area; the lack of women teachers as role models; and the aggressive behavior of the boys. One researcher in this area reported that teenage boys admitted to her in interviews that they deliberately harassed girls by telling them they were stupid in order to discourage them from signing up for after-school computer courses. (Rosser, p.15)

What do the girls think of computers? The women of the Math and Science Education Program for Women at the Lawrence Hall of Science asked teachers to ask their students to imagine that they were thirty years old and to describe how they would be using a computer. Here is one response from a

6th grade girl:

> "When I am thirty I'll have a computer that has arms that can clean the house and cook meals. And another computer that has a little slot that money comes out to pay for groceries and stuff."

Other responses from girls included a desire for computers to give news reports and tell where to shop for the prettiest clothes. (Kreinberg, p.17)

Almost 900 students, from grades four to twelve, responded to the questions. Kreinberg summarized the findings:

> "Overall, both males and female pictured the computer taking over a substantial part of their lives, but females tended to focus more on the housework and what the computer (robot) would do, while males described ways in which they would use the computer for finances, games, and work." (p.17)

Silvern and his colleagues conducted a study to determine children's "natural" interaction with a microprocessor. The "naturalness" included all cultural assumptions and values represented in a typical summer laboratory school program, but it did not include intentional instruction or encouragement from teachers. One Apple II microcomputer was placed in one of many learning centers of a large open classroom with thirty-nine children. At least one hour a day was center-time; who worked where was determined by a first-come, first-served arrangement.

It was found that 85 percent of the users of the computer were boys (p.6). They learned early in the time of the study that center time always came after group meeting time, and they would position themselves at advantageous spots in the

room in order to be the first at the computer. Some of the programs available to these students reflect the bias of the companies toward the intended audience: Battleship, Towers of Hanoi, Sink the Skip, and Super Invader Cosmos.

G. Gregory Smith, director of educational marketing for Apple Computer Inc., was quoted in the BUSINESSWEEK article admitting that Apple targets its ads towards males and has no intention of changing this. "The buyers are 98% male. We do not feel that women represent any great untapped audience." (p.102) Atari, another company, markets personal computers for women by color and decoration styling to appeal to women. (Rosenthal, cited in Zimmermann, p.359)

Is the situation for girls and women and computers as discouraging as the reports would have us believe? Will computers only serve to reinforce women's secondary role? Several researchers in this area do offer some hope and solutions to the problem. Linda Winkle suggests that intervention programs designed to lower computer anxiety and increase female involvement with computers be based on the same three variables affecting math anxiety: a positive attitude; a perceived need; and the influence of parents and teachers. (p.315) The Math and Science Education Program for Women at Lawrence Hall of Science is one such program which has been successful. Its program for teacher education, Project EQUALS, has served 1,500 California educators over the last five years, and they report a steady increase in the number of women in advanced mathematics classes in schools where the program has been working two or more years.

(Kreinberg, p.18) They also report that all students of EQUALS teachers have an improved attitude toward mathematics and an increased interest in math-related occupations.

Math for Girls is another Lawrence Hall program. Designed to give girls "hands-on" experiences in mathematics and increase their participation, the program has served 1,500 students and project director Kreinberg feels it has contributed to the increase in the percentage of females in all Hall classes from less than 25 percent in 1973 to 38 percent in 1980. (p.18) Another component of the program is that microcomputers are taken into the schools in several surrounding counties.

Also in California, Computer Camp Inc. in Santa Barbara, is encouraging girls to enroll and is accepting fewer boys, although they outnumber the girls 2 to 1 in applying for the two-week, $795 program. Using graphics and music producing synthesizers, the program allows children to experiment with computers in forms other than mathematics. (BUSINESSWEEK, p.102)

Adeline Naiman, director of Technical Education Research Center in Cambridge, Mass., is even hopeful about the impact of the microprocessor on women's lives. She feels that because microprocessors look somewhat like a combination of a television and a typewriter, both familiar objects to women, women should not be intimidated by them. They are friendly, nonjudging tools with which women can work alone and at their own pace, she says. (p.23) Word processing is really not too great a step from typing. The fact that marketers have called

them personal computers has a positive effect on women, too, she says. "Perhaps women are conditioned to like things to be personal rather than chilly and institutional." (p.23) She points to the increase in women's self-confidence when they master computer skills. Through well-designed educational programs, this could be passed on to girls and young women in our schools.

Naiman concludes her argument with three recommendations for the National Council of Teachers of Mathematics Agenda for Action: the use of computers in classroom by women teachers, both to increase their participation in the computer field and to encourage students to see women as role models for the use of technology; special efforts to include girls in computer-related instruction; the integration of computers into all subject areas as learning tools (p.24). If these recommendations are acted upon by our schools, as I believe they must be, equal access to computers could be an important step in alleviating the present condition of inequitable distribution of knowledge and power in our society. For feminist educators, the choice is clear.

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